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Aula LUF1 - Moderatore: Giovanna Battipaglia

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Earlywood anatomy improves forecasts of drought-induced dieback in Mediterranean ring-porous oaks

Some tree species have shown to be very vulnerable to drought and heat waves in the Mediterranean Basin, causing a loss of important socio-economic and ecosystem forest services. In this context, oaks are important species which are showing losses in terms of productivity and growth and rising mortality rates in some sites. Dendroecological studies using retrospective analysis of wood anatomical traits and tree rings have demonstrated their potential to assess long-term patterns of growth and vigor in several Mediterranean oak species. Furthermore, the long-term reconstruction of wood anatomical traits such as transversal lumen area, allows investigating adjustments of the potential hydraulic conductivity of trees through time. In this study, we reconstructed changes in earlywood anatomy for a 38-year long period (1980-2017) to investigate how drought affected the hydraulic functionality and triggered dieback in five ring-porous oak species showing dieback in Italy and Spain and characterised by different drought tolerance (from lower to higher tolerance: *Quercus robur, Quercus frainetto, Quercus cerris*, *Quercus canariensis, Quercus pubescens*). We compared non-decaying (ND) and decaying (D) coexisting trees of each species with low and high defoliation levels, respectively. We measured earlywood anatomical traits such as vessel area and density, hydraulic diameter (Dh), indices of vulnerability to cavitation and calculated the Clark-Evans' vessel spatial aggregation index. In addition, a new index (vessel Index) derived from the product of the vessel aggregation index and the coefficient of variation of vessel area was calculated. We observed differing growth patterns and and responses of xylem vessel in D trees compared with ND trees. In general, D trees formed narrower rings and EW vessels than ND and the Dh was lower in D trees. In addition, it was found that in climatically favorable years, the Vessel Index was higher in ND trees than in D trees. We discuss the relationships between radial growth, changes in earlywood anatomy and hydraulic functioning of trees focusing on those variables providing more predictive power of growth decline, canopy dieback, and tree mortality. These findings highlight the role played by hydraulic failure in ring-porous oak suffering drought-induced dieback.

Parole chiave: Climate warming, Forest die-off, Dendroecology, Quantitative wood anatomy, Tree mortality, *Quercus* spp, Mediterranean oaks

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